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NOISE PERFORMANCE OF IRIS/IDA  
BROADBAND SEISMIC STATIONS AAK AND TLY IN THE USSR

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## Summary

In this quarter, technical work on the contract concentrated on evaluating the performance of two broadband IDA stations installed in the USSR in fall 1990. These stations, Ala-Archa, Kirghizia (AAK; lat 42.639°N, lon 74.494°E, elev 1645 m) and Talaya (TLY; 51.681°N, lon 103.644°E, elev 579 m) near Lake Baikal in Siberia, were not included in the study of noise performance by Given (1990). AAK and TLY officially began operation on October 28, 1991 (Julian day 285). Their locations are shown in Figure 1. These are the first IDA USSR stations to incorporate triggered recording at a higher sample rate (200 sps) into the data logger (in this case, the IDA MK6a data logger). Thus, information on noise to higher frequencies (to 50 Hz) is available from the pre-trigger memory data records.

Findings can be summarized as follows: AAK shows the lowest average absolute nighttime noise levels above 1 Hz documented to date for IDA USSR stations. Ground noise increases during the day over night levels at AAK, with the maximum increase (7-9 dB) occurring between 2-3 Hz. Below .7 Hz, day and night noise levels are the same at AAK. TLY average nighttime ground noise levels are about 6-10 dB higher than AAK levels above 1 Hz. Below .6 Hz, nighttime levels at AAK and TLY are comparable, except that TLY has lower horizontal noise levels (4-5 dB) at periods longer than 25 s. Almost no difference between night and day noise levels was observed at TLY; in this sense it is unique among the IDA broadband stations in the USSR. Microseism peaks at both stations are comparable (between -135 to -140 dB relative to 1 (m/s<sup>2</sup>)<sup>2</sup>/Hz) at both stations.

## Method

Average ambient noise spectra were calculated following the method outlined in Given, 1990. A period of approximately one week was chosen for each station: for AAK, from 91:109 to 91:115; for TLY, from 91:144 to 91:149. In both cases, these time periods are shortly after IDA personnel made site visits to correct some operational problems. Times series were visually inspected to eliminate earthquakes, but otherwise no special care was taken to ensure unrepresentatively quiet noise levels. In general, the 'night' noise samples were taken between 00h-03h local time, and 'day' noise samples were taken between 12h-14h local time. A minimum of 5 time periods taken over the week were used to form the station average. For each time period, power spectral estimates were calculated by section averaging, using 8 sections of 500 s length, with a 50% overlap, where a Hann taper was applied to each section. The 95% confidence level of the spectral estimates are within -2.2 dB and +3.0 dB of the calculated value at each frequency. The three-component, night noise levels are shown for AAK and TLY in Figures 2 and 3. The difference between the average day time average night time noise levels are shown in Figure 4. The IDA broadband channels have a low-pass, anti-aliasing filter with a corner frequency of 5 Hz; this filter response has not been removed from the ground noise spectra, explaining the apparent decrease in noise levels above 5 Hz.

## Evaluation of Overall Station Performance: AAK and TLY

In terms of its noise performance, AAK was found to have comparable broadband noise levels to the quietest IDA USSR site found previously, GAR. The AAK April 1991 night sample is almost dB quieter than the GAR February 1989 night sample between 2-3 Hz; it is about equal to the GAR July 1989 night sample. Thus both stations are quieter than the other USSR IDA sites at ARU, KIV, and particularly OBN. TLY noise levels above 2 Hz can be characterized as between the low levels at AAK and GAR, and the intermediate levels at ARU and KIV. Both AAK and TLY have tunnel deployments, similar to the GAR site. The TLY tunnel is not cased, and is subject to substantial seasonal moisture. The TLY station is situated in a narrow, heavily wooded canyon, such that wind may be more of a consideration as a noise source than at AAK or GAR.

There have been some operational problems at these stations that have required the replacement of equipment (sensors and clocks). These problems, and their impact on the noise levels seen at the stations and overall data quality, will be discussed in the next technical report.

### References

Given, H.K., Variations in broadband noise at IRIS/IDA stations in the USSR with implications for event detection, *Bull. Seismol. Soc. Am.* 80, 2072-2088, 1990.



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### Figure Captions

Figure 1. Location map of seismic facilities in Eurasia showing IDA broadband seismic stations.

Figure 2. Average night time noise power spectra between 100 s and 10 Hz observed at the IDA stations AAK (Ala-Archa, Kirghizia) and TLY (Talaya, Siberia) in the USSR. Vertical scales are in decibels relative to acceleration,  $(1 \text{ m/s}^2)^2/\text{Hz}$ . Plots show vertical (top), north (middle), and east (bottom) components. Tunnel deployments, which tend to filter the effects of changing temperature and pressure, are very effective at maintaining a low noise environment at long periods ( $10^{-2}$  Hz). Noise levels at AAK above 1 Hz are the lowest of any IDA station in the USSR; TLKY noise levels above 1 Hz are somewhat lower than those seen at stations ARU and KIV.

Figure 3. Difference between average day time and average night time noise levels. at AAK (top) and TLY (bottom). TLY is unique among the IDA USSR stations to date in that it shows virtually no increase in day time over night time noise levels.

# Selected Eurasian Seismic Facilities

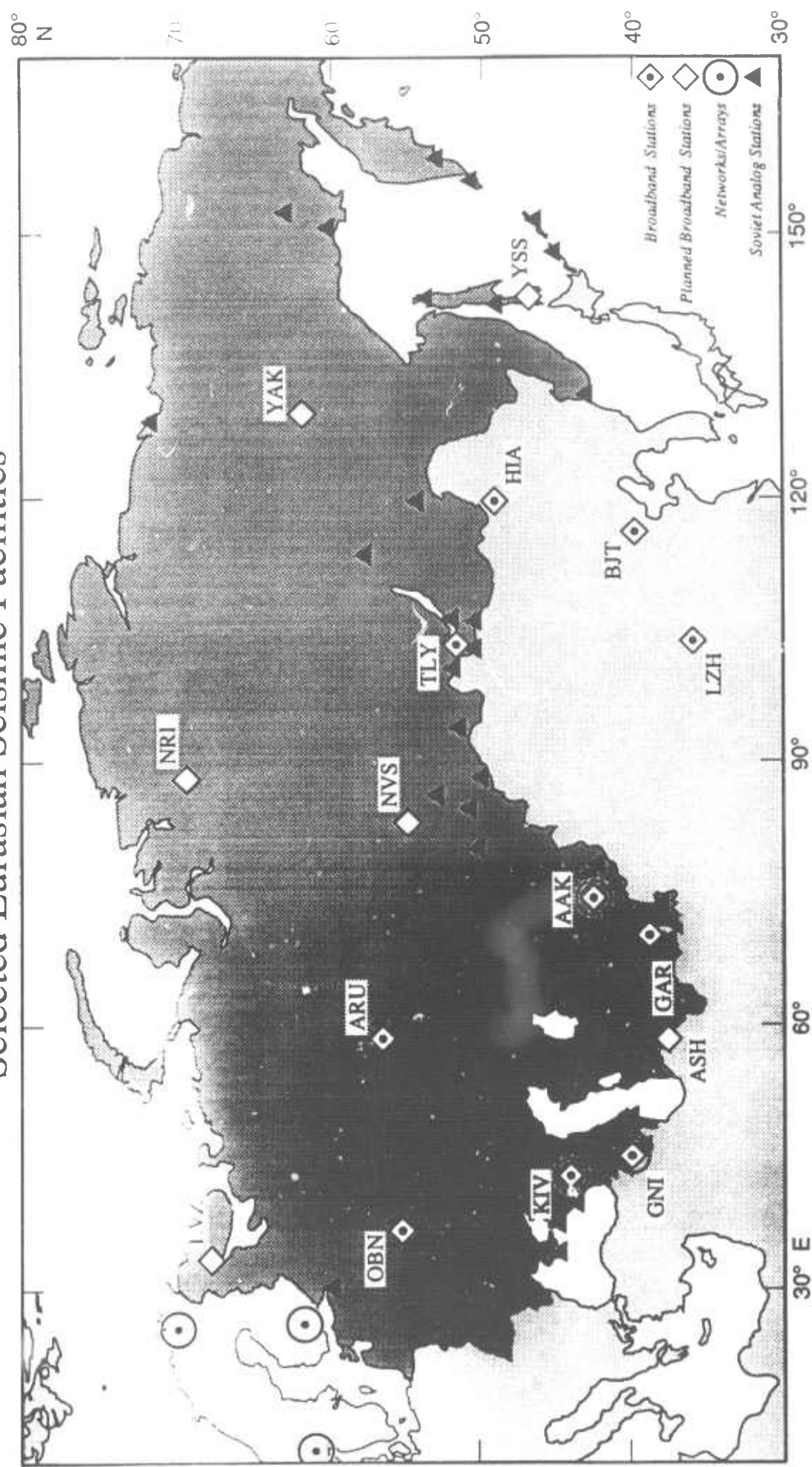
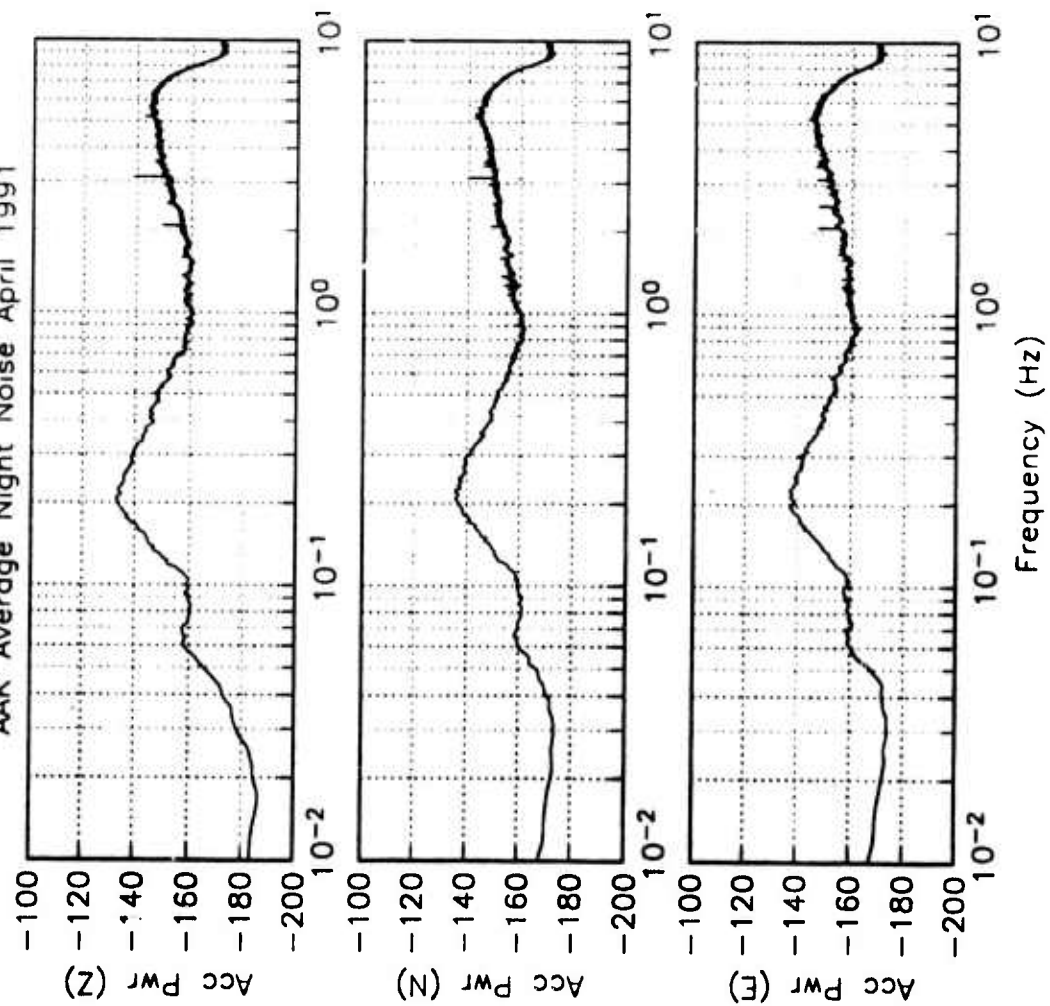


Figure 1. Location map of seismic facilities in Eurasia.



AAK Average Night Noise April 1991



TLY Average Night Noise May 1991

